

SA³L - Situation Awareness for Ambient Assisted Living

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1 Background and Motivation

A demographic change is occurring in many areas of the world. The population share in which people in age over 60 years has been increasing for the last decades and estimations predict that this group of elderly population will near quadruple in the year 2050 [1]. This change will bring exponentially increasing costs of health care [3], which will be supported by the decreasing share of younger people. One solution to this challenge is through technological developments aiming at reducing the costs of health care. Smart environments, [2], targeted for ambient assisted living, enable people to remain independent at their own home and to live in a decent way longer. Key functions of such environments are:

- Answering queries (where is the person, for example).
- Activity recognition (what the person is doing).
- Detection of specific behaviour and potentially dangerous situations.
- Fall monitoring.

Camera sensors have been used for the detection of human activities of daily living (ADL). However, the privacy issues of such camera-based solutions motivates the usage of other sensors such as wearable inertial sensors and accelerometers. A wearable sensor is dependent on several aspects of human behaviour such as remembering to put on the sensors and doing so properly. Other, often used, sensors in ubiquitous computing are switches, motion detectors and electromechanical sensors, which

do not, at the same extent, breach the privacy of individuals. Because of the large variety of sensor types and settings, information processing approaches, and individuals living in the environments, finding an accurate, robust and economically efficient solution to the problem is a hard task.

This project focuses on data mining methods and sensors to model human behaviour in home environments and techniques to infer knowledge from such models.

2 Goals

The main objectives of the SA³L project is to develop methods and tools for: answering queries, performing robust recognition of dangerous situations, detecting deviations of behaviour, generalizing easily over different homes and individuals, and exploiting online data streams to adapt processing algorithms in an incremental fashion.

3 Approach

The project is divided into seven work packages:

- **WP1. Customer needs, features and specification of foreseen product.**
This step involves investigating the need for future products and specifications of such products.
- **WP2. System for getting information from and interfacing with end users.**
To develop a web-based system for collecting information from the end users in order to receive ground-truth of human behaviour and alarm situations.

- **WP3. Upgrade the data collection environment.**

To upgrade the existing data collection environment. To develop a data simulator based collected data.

- **WP4. Data collection.**

This work package involves collecting data from different persons in their homes and also in a simulated home environment.

- **WP5. Data analysis.**

To develop methods and algorithms for achieving the project goals.

- **WP6. PhD education.**

During the project one to two persons will be educated with at least one Licentiate and one PhD level dissertation.

- **WP7. Evaluation of end results.**

To evaluate the quality of the end products, prototypes and services.

From the collaboration with the partners so far, there are several promising directions of research, which advocates investigating the fusion of several sources of information such as general prior knowledge about the elderly, self-reported surveys, nurse and relatives knowledge about the elderly, and the home environment floor plan.

4 Results

A technical report describing the analysis of attempts to complement the night care service with technology was made public available [4]. Various sensors (both wearable and sensors with a fixed position in the home) were used to collect data from 15 individuals during two–three weeks at night time. The collected patterns were analyzed to find characteristic patterns of behaviour for the individuals as well as similarity between individuals and deviations. The collected data were analysed in terms of scenarios, e.g. describing a visit to the bathroom, see Figure 1. Technical challenges related to data mining and incorporating algorithms into products were identified.



Figure 1: A wake-up scenario in a home environment equipped with several sensors. The coloured dots represent different events such as: waking up, stepping outside the bed, walking to the bathroom etc.

5 Partners and Status

Funding: The Knowledge Foundation.

Companies: Neat Electronics AB.

Other partners: Centre for Health Technology Halland.

References

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